

09/744160

JC02 Rec'd PCT/PTO 22 JAN 2001

- 1 -

## CLAIMS:

1. A bearing structure, comprising:  
fixed components; and  
rotatable components which are supported by the  
fixed components for rotation,  
wherein the fixed components and the rotatable  
components are kept out of contact with each other during  
rotations of the rotatable components, and  
the bearing structure further comprising a  
conductive structure for electrically connecting the fixed  
components and the rotatable components is provided on or  
in the vicinity of an axis of the rotational center of the  
bearing structure.
2. A bearing structure according to Claim 1,  
wherein the conductive structure comprises  
magnetic fluid.
3. A bearing structure according to Claim 1,  
wherein the conductive structure is an elastic  
component which is fixed to one of either the fixed  
components or the rotatable components and in contact with  
the other thereof.
4. A bearing structure according to Claim 3,

- 2 -

wherein the elastic component is a curved flexible conductive strip.

5. A bearing structure according to Claim 3,  
5 wherein the elastic component is a flexible conductive ring.

6. A bearing structure according to Claim 1,  
10 wherein the conductive structure comprises a conductive headed pin, which is fitted into a blind hole provided on the one of either the fixed components or the rotatable components in a movable manner in an axial direction, and pushed by a elastic body so that a spherical head thereof serving as a contact point is kept in contact  
15 with the other thereof.

7. An air bearing having the conductive structure according to Claim 6,  
20 wherein the elastic body is a coil spring made of conductive materials.

8. A bearing structure according to Claim 1,  
25 wherein the conductive structure comprises a bundle of conductive fibers, one end of which is bundled and fixed to the rotatable components, and the other end of

A  
Cont

- 3 -

which is a free end which is inserted into a hole provided on the fixed components.

9. A bearing structure according to Claim 1, wherein  
5 the conductive structure comprises:

a spindle which is fitted into and guided by a sleeve fixed to one of either the fixed components or the rotatable components in a manner capable of relative rotation, which spindle has a groove or grooves on an outer peripheral surface thereof for generating hydrodynamic pressure to generate thrust force for pushing a spherical contact point at one end of the spindle into the sleeve by the effect of the relative rotation; and

15 a strand composed of conductive fibers, one end of which is fixed to the other of either the fixed components or the rotatable components and the other end of which is fixed to an end opposed to the spherical contact point of the spindle with having sagging.

20            10. A bearing structure according to Claim 9,

wherein the conductive fibers are composed of any one of boron, carbon monofilaments, or tungsten, or a combination thereof.

25            11. A bearing structure according to Claim 1,

- 4 -

wherein means for supporting the rotatable components in non-contact state against the fixed components is a hydrodynamic gas bearing.

5

12. A bearing structure according to Claim 11, wherein one or more bearing components constituting a radial bearing section and a thrust bearing section of the hydrodynamic gas bearing are made of ceramics.

10

13. A bearing structure having a hydrodynamic gas bearing, comprising:

fixed components; and

15

rotatable components which are supported by the fixed components for rotation,

wherein the fixed components and the rotatable components are kept in non-contact state during rotation of the rotatable components, and

20

wherein among bearing components constituting a radial bearing section and a thrust bearing section of the hydrodynamic gas bearing, at least a pair of bearing components coming into contact with each other when rotation stops is made of conductive ceramics.

25

14. A bearing structure according to Claim 13,

- 5 -

wherein the conductive ceramics is made of  $\text{Al}_2\text{O}_3$ -  
30vol% $\text{TiC}$ ,  $\text{TiB}_2$ , or  $\text{Si}_3\text{N}_4$ -30vol% $\text{TiN}$ .

5 15. A bearing structure having a hydrodynamic gas  
bearing, comprising:

fixed components; and

rotatable components which are supported by the  
fixed components for rotation,

10 wherein the fixed components and the rotatable  
components are kept in non-contact state during rotation of  
the rotatable components,

15 the bearing structure further comprising a  
conductive structure having a magnetic fluid for  
electrically connecting the fixed components and the  
rotatable components either in the region where there is no  
air flow generated by suction or discharge of a gas, for  
generating hydrodynamic pressure at the hydrodynamic gas  
bearing portion, or in the region where the air flow is  
negligible.

20

16. A spindle motor having the bearing structure  
according to Claim 15.

25 17. A hard disk drive having the spindle motor  
according to Claim 16.

A!  
Cont  
sub  
B5

- 6 -

18. A hard disk drive, comprising:

a plurality of storage media which enable recording or replaying information, or both thereof;

5 a spindle motor which rotates a plurality of the storage media mounted thereon; and

*Al Cont*

a plurality of head assemblies each of which access each information storage surface of a plurality of the storage media, and perform recording or replaying information, or both thereof in non-contact state with the rotating information media,

10

wherein there is provided a discharge induction structure for inducing discharge of electrostatic charge between a dummy disk specified among a plurality of the storage media and a dummy head specified among a plurality of head assemblies.

15

19. A hard disk drive according to Claim 18,

wherein the discharge induction structure is so structured that a gap between the dummy head and the dummy disk is smaller than a gap between other storage media and other head assemblies accessing thereto during operation in a non-contact state.

20

25 20. A hard disk drive according to Claim 19,

- 7 -

wherein a gap between the dummy head and the dummy disk is about a half of or less than a half of a gap between other storage media and other head assemblies accessing thereto.

5

21. A hard disk drive according to Claim 19,  
wherein a gap between the dummy head and the dummy disk is 15nm or less.

10

22. A hard disk drive according to Claim 18,  
wherein the discharge induction structure is so structured that conductivity of the dummy disk is higher than conductivity of other storage media.

15

23. A hard disk drive according to Claim 18,  
wherein the discharge induction structure is so structured that conductivity of at least either one of the dummy head or a carriage supporting the dummy head is higher than conductivity of other head assemblies or other carriages, respectively.

20

24. A hard disk drive according to Claim 18,  
wherein the spindle motor for driving the storage media has a hydrodynamic gas bearing.

25

A1  
Cont

20014 1月22日 10時12分  
AVIAMA & PARTINERO  
NO. 9030 P. 0/9

- 8 -

25. A hard disk drive according to Claim 24,  
wherein one or more bearing components  
constituting a radial bearing section and a thrust bearing  
section of the hydrodynamic gas bearing are made of  
ceramics.

5

26. A method for avoiding damages caused by  
electrostatic charge in a hard disk drive having a  
plurality of head assemblies each of which accesses each of  
the plurality of rotating storage media for performing  
recording or replaying information, or both thereof between  
the head assemblies and the storage media,

10

comprising the step of inducing an electrostatic  
charge built up in either one of the head assemblies or the  
storage media to be discharged to the other thereof between  
a storage medium specified among a plurality of the storage  
media and a head assembly specified among a plurality of  
the head assemblies, so as to eliminate damages attributed  
to discharge of electrostatic charge from other components  
composing the hard disk drive.

15

20

Al  
Cont

THIS DOCUMENT IS UNCLASSIFIED  
DATE 01-11-2001 BY 60322 UCBAW